TRANSMISSION TEST REQUIREMENTS TABLES
DESCRIPTION

CONTENTS

	PAGE
1. GENERAL	1
2. DESCRIPTION OF TABLE USED FOR 1-kHz LOSS REQUIREMENTS	1
TRANSMISSION LOSSES FOR CIRCUIT	2
INDIVIDUAL APPARATUS LOSSES	3
3. TABLE USED FOR GAIN REQUIREMENTS AT SINGLE AND MULTIFREQUENCIES AND LOSS REQUIREMENTS AT MULTIFREQUENCIES	4
TRANSMISSION GAIN OR LOSS FOR CIRCUIT	5
INDIVIDUAL APPARATUS LOSSES	5
4. TRANSMISSION NOTES	6
REASONS FOR REISSUE	7

1. GENERAL

1.01 This section describes the transmission test requirements tables and transmission notes as shown on the circuit drawings.

1.02 This section is reissued to revise the transmission test requirements tables and descriptions and, in general, to bring the section up to date. Detailed reasons for reissue will be found at the end of the section.

1.03 Terminology within this section has been revised to bring it up to date with the present International Organization for Standardization nomenclature. Previously, frequency measurement values were expressed in cycles, kilocycles, or megacycles. Frequency values are now expressed in hertz (Hz), kilohertz (kHz), or megahertz (mHz). For example, 300 cycles, 1 kilocycle, 3 megacycles are now expressed as 300 hertz (300 Hz), 1 kilohertz (1 kHz), 3 megahertz (3 mHz), respectively.

1.04 The transmission test requirements tables and transmission notes form a part of the voice frequency circuit drawings.

1.05 Two general types of transmission test requirements tables are shown on circuit drawings. One type covers 1-kHz loss requirements and is described in Part 2. The other type covers gain requirements at single and multifrequencies, and loss requirements at multifrequencies, and is described in Part 3.

1.06 In cases where the testing information cannot readily be specified in transmission test requirements tables, notes covering this information are shown on the circuit drawings. These notes are described in Part 4.

1.07 Information given in the transmission test requirements tables and transmission notes does not include losses of office wiring or the conductor losses of the outside plant.

1.08 Information in the transmission test requirements tables and transmission notes is revised when necessary in connection with circuit changes and is accordingly kept up to date by this means.

1.09 On multifrequency transmission test requirements tables, all 1-kHz measurements designated with a circle dot (⊙), shall be made by the installer on shop tested equipment, regardless of whether they have been requested by the customer.

2. DESCRIPTION OF TABLE USED FOR 1-kHz LOSS REQUIREMENTS

2.01 *Title of Table:* Each transmission test requirements table has the title TRANSMISSION TEST REQUIREMENTS (1 kHz LOSS BETWEEN 600 OHM TERMINATIONS). Under the above heading, the table contains only 1-kHz loss measurements which will be made by the installer and the circle (⊙) will not be shown.

2.02 *Form of Table:* The 1-kHz loss transmission test requirements table shown on circuit drawings is usually of the type illustrated in

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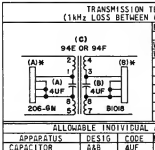
Fig. 1 through 5. It is divided into two main divisions which are fixed, except that the part of the table giving the maximum allowable circuit loss is subdivided when necessary to fit the circuit conditions. One of the main divisions is arranged for the transmission losses for the circuit in its talking condition and the other for the transmission losses of the individual pieces of apparatus involved. The specified losses apply to the condition of test only and, while they serve to check the condition of the equipment, they do not always correspond to the loss under actual talking conditions.

TRANSMISSION LOSSES FOR CIRCUIT

2.03 The transmission losses shown in the table are the losses for the test condition with a sending power of 1 mW at 1 kHz between 600-ohm terminations and do not necessarily bear any close relation to the loss assignable to the apparatus in computing the overall equivalent of a complete circuit between subscribers.

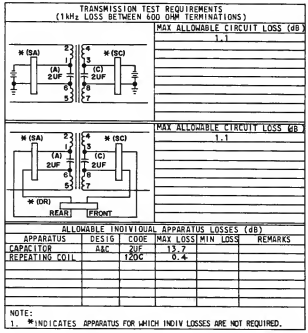
2.04 Referring to Fig. 1, it is to be noted that the top part of the table is divided into two parts. The part at the left consists of a diagram of the transmission circuit for which the requirements are specified, and the part at the right gives the maximum allowable circuit loss in decibels (dB). In some cases, as shown in Fig. 2, the maximum allowable circuit loss is shown directly under the sketch of the transmission circuit. When losses for more than one transmission condition are required for a circuit, provision is made for the additional space required for the associated maximum allowable circuit losses.



ALLOWABLE INDIVIDUAL APPARATUS LOSSES (dB)					
APPARATUS	DESIG	CODE	MAX LOSS	MIN LOSS	REMARKS
CAPACITOR	A&B	4UF	19.6	17.5	
REPEATING COIL	C	94E	0.9		
REPEATING COIL	C	94F	1.3		

NOTE:
1. *INDICATES APPARATUS FOR WHICH INDIV LOSSES ARE NOT REQUIRED.

Fig. 1



ALLOWABLE INDIVIDUAL APPARATUS LOSSES (dB)					
APPARATUS	DESIG	CODE	MAX LOSS	MIN LOSS	REMARKS
CAPACITOR	A&C	2UF	13.7		
REPEATING COIL		120C	0.4		

NOTE:
1. *INDICATES APPARATUS FOR WHICH INDIV LOSSES ARE NOT REQUIRED.

Fig. 2

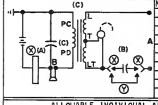
2.05 Each piece of apparatus is designated on the diagram with the same designation given it on the circuit drawing. The number which previously appeared in the upper left-hand corner of the space containing the diagram was the file number of the transmission condition. This number should be disregarded and does not appear on new tables.

2.06 In the space below the sketch or at the right side of it, the transmission loss in decibels (dB) is given under the heading MAX ALLOWABLE CIRCUIT LOSS (dB).

(a) In certain cases, as shown in Fig. 3, 4, and 5, specifying the loss for an operator telephone circuit, the space under the heading MAX ALLOWABLE CIRCUIT LOSS (dB) is divided into two parts to provide for bridged and transmitting losses. These divisions are headed BRDG and TRMTG, respectively. In other cases a receiving circuit loss only is specified and the BRDG column is left vacant.

(b) In certain cases, as shown in Fig. 4, when specifying the loss for an operator telephone circuit, the space under the heading MAX ALLOWABLE CIRCIT LOSS (dB) is divided into three parts to provide for receiving and transmitting losses at various

TRANSMISSION TEST REQUIREMENTS
(1kHz LOSS BETWEEN 600 OHM TERMINATIONS)



MAX ALLOWABLE CIRCUIT LOSS (dB)		
	BRDG A-A	TRMTG A-B
1kHz X OPTION	2.3	11.2
1kHz Y OPTION	2.3	11.2

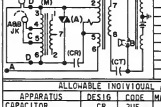
ALLOWABLE INDIVIDUAL APPARATUS LOSSES (dB)

APPARATUS	DESIG	CODE	MAX LOSS	MIN LOSS	REMARKS
CAPACITOR	B	1UF	8.3	6.6	
CAPACITOR	C	3UF	12.2	10.1	
INDUCTION COIL	C	63	11.6	10.6	

NOTE:
1. *INDICATES APPARATUS FOR WHICH INDIV LOSSES ARE NOT REQUIRED.

Fig. 3

TRANSMISSION TEST REQUIREMENTS
(1kHz LOSS BETWEEN 600 OHM TERMINATIONS)



MAX ALLOWABLE CIRCUIT LOSS(dB)				
TEMP °F	TRMTG	RCVG		
	A-B	A-C	A-D	
		A&B JK	C&D JK	
ALL 10.4	-	14.0	6.2	
70	-	14.1	6.4	
80	-	14.3	6.6	
90	-	14.5	6.6	
100	-	14.7	6.7	
110	-	14.9	6.9	

ALLOWABLE INDIVIDUAL APPARATUS LOSSES (dB)

APPARATUS	DESIG	CODE	MAX LOSS	MIN LOSS	REMARKS
CAPACITOR	CR	2UF	13.7	11.7	
CAPACITOR	CT	3UF	17.2	15.1	
INDUCTION COIL	T	1818	11.1	9.5	
REPEATING COIL	M	189E	1.2	0.6	
VARISTOR	A	33L			SEE NOTE 2

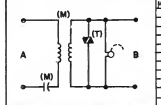
NOTE:
1. *INDICATES APPARATUS FOR WHICH INDIVIDUAL LOSSES ARE NOT REQUIRED.
2. METHOD OF MAKING INDIV APPARATUS LOSS TEST. SEE BSP ON TRANSMISSION TEST OF VARISTORS.
   REQT USING 12dB PAD
   TEMP AT VARISTOR °F 70 80 90 100 110
   INDIV LOSS 33L VARISTOR (dB) 0.4 0.5 0.6 0.7 0.8
3. 82 TYPE PLUG TO SUPPLY 40 OHMS IN PLACE OF TRANSMITTER AT B AND 200 OHMS IN PLACE OF THE RECEIVER AT C OR D.

Fig. 4

temperatures. These divisions are headed TEMP °F, TRMTG, and RCVG, respectively. Under the receiving (RCVG) loss column, subdivision may be provided to show the losses for the A&B and C&D jacks.

(c) In certain cases, as shown in Fig. 5, when specifying the loss for an operator telephone circuit, the space under the heading MAX ALLOWABLE CIRCUIT LOSS (dB) is

TRANSMISSION TEST REQUIREMENTS
(1kHz LOSS BETWEEN 600 OHM TERMINATIONS)



MAX ALLOWABLE CIRCUIT LOSS (dB)		
	BRDG A-A	RCVG A-B
189D	0.6	11.8

ALLOWABLE INDIVIDUAL APPARATUS LOSSES (dB)

APPARATUS	DESIG	CODE	MAX LOSS	MIN LOSS	REMARKS
CAPACITOR	M	0.5 UF	3.9	2.7	
REPEATING COIL	M	189D	11.3	10.6	
VARISTOR	T	33L			SEE NOTE 1

NOTE:
1. METHOD OF MAKING INDIV APPARATUS LOSS TEST. SEE BSP ON TRANSMISSION TEST OF VARISTORS.
   REQT USING 12 dB PAD
   TEMP AT VARISTOR °F 70 80 90 100 110
   INDIV LOSS 33L VARISTOR(dB) 0.4 0.5 0.6 0.7 0.8

Fig. 5

divided into two parts to provide for bridged and receiving losses. These divisions are headed BRDG and REC, respectively.

INDIVIDUAL APPARATUS LOSSES

2.07 The lower portion of the table, referring again to Fig. 1, is headed INDIVIDUAL APPARATUS LOSSES (dB) and is subdivided into six columns, namely, APPARATUS, DESIG, CODE, MAX, MIN, and REMARKS. Information pertaining to these headings is given in the following paragraphs.

2.08 The individual apparatus losses are for use only in those cases in which the circuit fails to meet the overall requirement, and it becomes necessary to measure the individual pieces of apparatus to determine the cause.

2.09 ***Apparatus:*** In this column is listed the name of each piece of apparatus, such as relay, repeating coil, etc, for which individual losses are given. This includes each piece of apparatus in the transmission circuit which is not marked with an asterisk (*) on the transmission sketch. Individual losses are not specified for resistors since they can be measured with a Wheatstone Bridge or ohmmeter. If the resistors affect transmission, they are not marked with an asterisk (*) on the transmission sketch. When one or more pieces of apparatus are marked

with an asterisk (*), the following note appears at the bottom of the transmission table:

* Indicates apparatus for which individual losses are not required.

2.10 The conditions under which individual losses are not given are usually where the equipment is shunted by means of a capacitor, or other apparatus of lower impedance, such as shown in Fig. 2 through 5, and also in some cases where two pieces of equipment of considerably different impedance are connected in series and the combination bridged across the circuit. An example of this latter condition is a toll cord circuit in which a relay of relatively low impedance is connected in series with an inductor.

2.11 ***Desig (Designation):*** The circuit designation of each piece of apparatus shown in the sketch for which individual losses are given is shown in this column.

2.12 ***Code:*** In this column are given the code numbers of the various pieces of apparatus with the exception of capacitors and resistors. In the case of capacitors the capacitance is given, and in the case of resistors the resistance is given in this column.

2.13 ***Max (Maximum Loss):*** This column is provided for the transmission losses of the individual pieces of apparatus as measured between impedances of 600 ohms using a 600-ohm transmission set having a sending power of 1 mW at 1 kHz. Unless otherwise specified, the connections of the apparatus to the transmission measuring set shall be the same (with the exception of capacitors) as is used in the respective transmission circuits. For example, series connected apparatus is tested in series and shunt connected apparatus is tested in shunt. Capacitors having a capacitance of 0.25 μF or more, regardless of their connection in the respective transmission circuits, are tested in shunt. Capacitors having a smaller capacitance are tested in series.

2.14 ***Min (Minimum Loss):*** In some cases it is necessary to work to a minimum transmission loss which is given in this column. For example, the induction coil of operator telephone circuits, as covered in Fig. 3, 4, or 5, requires such a loss limit. The conditions of measurement shall be the same as covered under Max (Maximum Loss).

2.15 ***Remarks:*** Any remarks which are necessary in connection with the transmission losses, including references to notes, are placed in this column.

2.16 ***Notes:*** Any information within the table which requires additional explanation appears in the notes at the bottom of the table.

3. TABLE USED FOR GAIN REQUIREMENTS AT SINGLE AND MULTIFREQUENCIES AND LOSS REQUIREMENTS AT MULTIFREQUENCIES

3.01 ***Title of Table:*** Each transmission test requirements table has the general title TRANSMISSION TEST REQUIREMENTS with one of the following subtitles in parenthesis under the general title. (LOSS BETWEEN 600 OHM TERMINATIONS), (1 kHz GAIN BETWEN 600 OHM TERMINATIONS), or (GAIN BETWEEN 600 OHM TERMINATIONS).

3.02 ***Form of Table:*** The gain or loss transmission test requirements table shown on circuit drawings is usually of the type illustrated either in Fig. 6 or 7. It shows the circuit gain or loss at all necessary testing frequencies, and some of these tables also show the individual apparatus losses. The specified gains or losses for the circuit apply to the condition of test only; and while they serve to check the condition of the equipment, they do not always correspond to the gain or loss under actual talking conditions.

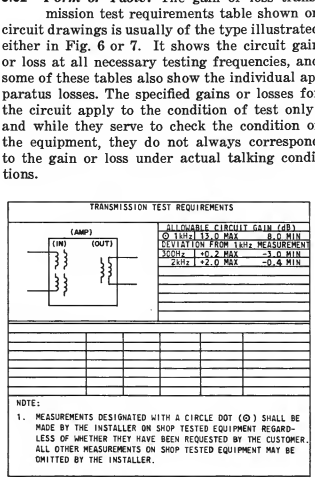


Fig. 6

TRANSMISSION GAIN OR LOSS FOR CIRCUIT

3.03 The transmission test requirements shown in the table are the gains or the losses at the frequencies shown in the table as measured between 600-ohm impedances and do not necessarily bear any close relation to the gain or loss assignable to the apparatus in computing the overall equivalent of a complete circuit between subscribers.

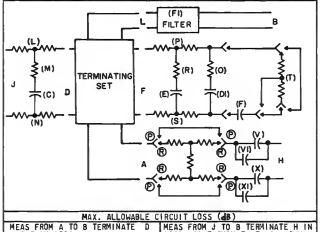
3.04 In the table shown in Fig. 6, maximum and minimum gain requirements are given for a typical amplifier at 1 kHz, and maximum and minimum gain requirements are given at 300 Hz and 2 kHz in terms of deviation from the 1-kHz measurement. Since in this case the amplifier is tested as a unit, a detailed sketch of the transmission circuit is not shown in the table. In these cases individual apparatus losses are generally not shown. Referring to Fig. 7 which covers transmission requirements for 4-wire terminating equipment, it is to be noted that the table is divided into two parts. The upper part consists of a diagram of the transmission circuit and the lower part directly under the sketch gives the allowable circuit loss or gain in decibels (dB). The lower part is further divided into two parts, one for the overall circuit loss or gain and the other for trouble location measurements. Where trouble location measurements are specified, individual apparatus loss limits are not shown. As covered in the note at the bottom of the table, it is not necessary for the installer to make all of the loss measurements if the equipment has been assembled in the shop. Additional trouble location circuit loss requirements are also shown in Fig. 7.

3.05 Each piece of apparatus is designated on the diagram with the same designation given it on the circuit drawing. The number which previously appeared in the upper left-hand corner of the space given over to the diagram was the file number of the transmission condition. This number should be disregarded on older tables and does not appear on new tables.

INDIVIDUAL APPARATUS LOSSES

3.06 The lower portion of the table, referring to Fig. 2, is headed INDIVIDUAL APPARATUS LOSSES at 1 kHz (dB) and is subdivided into six columns, namely, APPARATUS,

TRANSMISSION TEST REQUIREMENTS
(LOSS BETWEEN 600 OHM TERMINATIONS)



MAX. ALLOWABLE CIRCUIT LOSS (dB)

MEAS FROM A TO B TERMINATE D AND F IN 600Ω ±1%		MEAS FROM J TO B TERMINATE H IN 600Ω ±1% TERMINATE F AS SHOWN	
⊙ 1kHz	46 MIN	⊙ 1kHz	10.3 MAX 3.2 MIN

MEAS FROM O TO B TERMINATE H AND F IN 600Ω ±1%		MEAS FROM H TO J TERMINATE B IN 600Ω ±1% TERMINATE F AS SHOWN	
CIRCUITS EQUIPPED WITH 32B FILTERS		PAD IN 4 WIRE RECEIVING SIDE SHALL BE ARRANGED FOR MAX. LOSS	
⊙ 1kHz	5.0 MAX 3.5 MIN	⊙ 1kHz	22.3 MAX
DEVIATION FROM 1kHz MEASUREMENT			
300Hz	+9.6 MAX +3.6 MIN		
2kHz	+6.3 MAX +2.1 MIN		
2.4kHz	+8.8 MIN		

CIRCUITS EQUIPPED WITH 32B FILTERS		TROUBLE LOCATION MEASUREMENTS		
⊙ 1kHz	5.0 MAX 3.5 MIN	MEAS FROM O TO L TERMINATE H AND F IN 600Ω ±1%		
DEVIATION FROM 1kHz MEASUREMENT		⊙ 1kHz	4.5 MAX	3.5 MIN
300Hz	+9.6 MAX +3.6 MIN	DEVIATION FROM 1kHz MEASUREMENT		
2kHz	+1.6 MAX -0.4 MIN	300Hz	+9.6 MAX	+3.6 MIN
2.2kHz	+2.6 MAX -0.3 MIN	2kHz	+0.8 MAX	-0.8 MIN
2.4kHz	+6.4 MAX +2.2 MIN	3kHz	+1.0 MAX	-1.0 MIN

CIRCUITS EQUIPPED WITH 32C FILTERS		MEAS FROM L TO B		
⊙ 1kHz	5.0 MAX 3.5 MIN	32B FILTER		
DEVIATION FROM 1kHz MEASUREMENT		⊙ 1kHz	0.5 MAX	
300Hz	+9.6 MAX +3.6 MIN	2kHz	7.5 MAX	2.5 MIN
2kHz	+0.8 MAX -0.7 MIN	2.4kHz		10.0 MIN
2.4kHz	+3.4 MAX +0.7 MIN	32B FILTER		
2.9kHz	+9.0 MAX +3.4 MIN	⊙ 1kHz	0.5 MAX	
3kHz	+9.2 MIN	2kHz	1.0 MAX	
		2.4kHz	7.5 MAX	2.5 MIN
		2.6kHz		10.0 MIN
		32C FILTER		
		⊙ 1kHz	0.5 MAX	
		2kHz	1.0 MAX	
		2.8kHz	9.5 MAX	4.5 MIN
		3kHz		10.0 MIN

MEAS FROM J TO D	
⊙ 1kHz	5.4 MAX 4.6 MIN

MEAS FROM H TO D TERMINATE F AND 3 IN 600Ω ±1% R OPTION	
R OPTION PAD ARRANGED FOR MAX LOSS	
⊙ 1kHz	17.0 MAX 15.0 MIN
R OPTION PAD ARRANGED FOR MIN LOSS	
⊙ 1kHz	7.0 MAX 5.0 MIN

P OPTION	
⊙ 1kHz	4.5 MAX 3.5 MIN
DEVIATION FROM 1kHz MEASUREMENT	
300Hz	+16.4 MAX +9.6 MIN
2kHz	+0.8 MAX -0.8 MIN
3kHz	+1.0 MAX -1.0 MIN

NOTES:

1. MEASUREMENTS DESIGNATED WITH A CIRCLE DOT (⊙) SHALL BE MADE BY THE INSTALLER ON SHOP TESTED EQUIPMENT REGARDLESS OF WHETHER THEY HAVE BEEN REQUESTED BY THE CUSTOMER. ALL OTHER MEASUREMENTS ON SHOP TESTED EQUIPMENT MAY BE OMITTED BY THE INSTALLER.
2. IF THE MEASUREMENT FROM J TO B DOES NOT MEET ITS REQT, THE CKT WILL BE CONSIDERED SATISFACTORY IF MEASUREMENTS FROM J TO D AND D TO B MEET THEIR REQT. IF THE MEASUREMENTS FROM D TO B DO NOT MEET REQT, THE CKT WILL BE CONSIDERED SATISFACTORY IF MEASUREMENTS FROM O TO L MEET THEIR REQT. IF THE MEASUREMENT FROM H TO J DOES NOT MEET ITS REQT, THE CKT WILL BE CONSIDERED SATISFACTORY IF MEASUREMENTS FROM J TO D AND H TO D MEET THEIR REQT.
3. THE BUILDING OUT EQUIPMENT (F) CAPACITOR AND (T) RESISTOR WHEN PROVIDED SHALL BE DISCONNECTED WHILE MAKING TESTS.

Fig. 7

DESIG, CODE, MAX, MIN, and REMARKS. Information pertaining to these headings is given in the following paragraphs.

3.07 The individual apparatus losses are for use only in those cases in which the circuit fails to meet the overall requirement, and it is necessary to measure the individual pieces of apparatus to determine the cause. On circuits where the individual apparatus losses are not useful in determining the cause of a failure to meet the overall requirements the individual apparatus losses are not shown in the table (see Fig. 6 and 7). Individual losses are not specified for resistors since they can be measured with a Wheatstone Bridge or ohmmeter. If the resistors affect transmission, they are not marked with an asterisk (*) on the transmission sketch.

3.08 ***Apparatus:*** In this column is given the name of each piece of apparatus, such as relay, repeating coil, etc, for which individual losses are given.

3.09 ***Desig (Designation):*** The circuit designation of each piece of apparatus shown in the sketch for which individual losses are given is shown in this column.

3.10 ***Code:*** In this column are given the code numbers of the various pieces of apparatus with the exception of capacitors and resistors. In the case of capacitors the capacitance is given, and in the case of resistors the resistance is given in this column.

3.11 ***Max (Maximum Loss):*** This column is provided for the transmission losses of the individual pieces of apparatus as measured between impedances of 600 ohms, using a 600-ohm transmission set having a sending power of 1 mW at 1 kHz. Unless otherwise specified the connections of the apparatus to the transmission measuring set shall be the same (with the exception of capacitors) as is used in the respective transmission circuits. For example, series connected apparatus is tested in series and shunt connected apparatus is tested in shunt. Capacitors having a capacitance of 0.25 μF or more, regardless of their connection in the respective transmission circuits, are tested in shunt. Capacitors having a smaller capacitance are tested in series.

3.12 ***Min (Minimum Loss):*** In some cases it is necessary to work to a minimum transmission loss which is given in this column. For example, the capacitor in circuits requires such a loss limit. The conditions of measurement shall be the same as covered under Max (maximum loss).

3.13 ***Remarks:*** Any remarks which are necessary in connection with the transmission losses including references to notes are placed in this column.

3.14 ***Notes:*** Any information within the table which requires additional explanation appears in the notes at the bottom of the table.

4. TRANSMISSION NOTES

4.01 When the transmission test requirements cannot be readily covered in tables similar to those already described, the information is given on the circuit drawings in the form of TRANSMISSION NOTES. These requirements appear on the drawings as the 500 series of notes.

4.02 The transmission notes give complete information regarding the allowable gain, loss, or required output for the particular circuit on which they appear.

4.03 The following information illustrates the use of transmission notes on the circuit drawings:

Transmission Notes

5.01 Depending upon trunk conductor loss (at 1 kHz), provide 89-type resistor in accordance with Table A.

TABLE A

TRUNK CONDUCTOR LOSS	MON PAD	
	LOSS	RESISTOR
dB	dB	TYPE
0	16.5	89BP
0.5	16.0	89BN
1.0	15.5	89BM
1.5	15.0	89BL
2.0	14.5	89BK
2.5	14.0	89BJ
3.0	13.5	89BH
3.5	13.0	89BG
4.0	12.5	89BF
4.5	12.0	89BE
5.0	11.5	89BD
5.5	11.0	89BC
6.0	10.5	89BB

5.02 With the MON pad equipped with the proper 89-type resistor (see 5.01), adjust the MON amplifier such that the overall gain (+) or (−) of the transmission circuit when added to the trunk conductor loss (at 1 kHz) of the T and R pair will result in a net loss of 11.5 dB. For this adjustment, use 900-ohm test equipment (Model TTS-4 transmission test set or equivalent) and connect a 1-kHz source at 0 dBm to the AMP IN jack and read the gain or loss at the AMP OUT jack.

REASONS FOR REISSUE

1. To include a table of contents.
2. To add paragraph covering reason for terminology revision (1.03).
3. To delete information covering table used for return loss or singing point and composite set impedance unbalance requirements (1.04, Part 4, and Fig. 5 and 7 of previous issue).
4. To delete information covering repeating coils having silicon steel cores which replaced repeating coils having permalloy cores (1.08 through 1.10 of previous issue).
5. To include paragraph defining circle dot (⊙) designation on multifrequency transmission test requirements tables (1.09).
6. To revise figures in accordance with current drafting standards (Fig. 1, 2, 3, and 7).
7. To revise paragraphs to delete reference to file number which previously appeared in upper left-hand corner of the tables (2.05 and 3.05).
8. To revise paragraph describing contents of tables (2.05).
9. To add Fig. 4 and 5.
10. To revise Part 4 covering transmission notes to include current examples of notes (Part 5 of previous issue).